

STEREO MOC Status Report
Time Period: 2015:313 - 2015:319

STEREO Ahead (STA) Status:

1. The following Ground System anomalies/events occurred during this reporting period:

- On day 317, during the DSS-63 support, turbo decoder lock was lost at 1132z. This anomaly resulted in the loss of one frame of SSR data.

2. The following spacecraft/instrument events occurred during this week. The Ahead observatory operated nominally during this week resuming operations on the HGA main lobe riding along a one degree offset to prevent overheating of the HGA feed assembly which was at 119 degrees C and decreasing with the HGA angle at 7.1 degrees and increasing, with respect to the spacecraft-Sun line. The 15 months of in-situ instruments science data on the SSR have been played back twice and all science data has been received. NOAA antenna partners will gradually be able to close the RF link on the space weather broadcast. On day 321, November 17th, instruments will begin reconfiguration for resuming nominal daily science data return.

- On day 312, during the DSS-63 support, temporary macro 237 was loaded to C&DH RAM to continue to provide 10 kbps real-time science data and increase SSR playback ratio to 35 during the 360 kbps downlink supports.
- On day 313, during the DSS-26 support, at 2000z the STEREO Ahead observatory resumed operations using the main lobe of the HGA, resulting in a 13 dB signal increase. The HGA soft stop was set to 7.1 degrees and the HGA will be riding along a one degree offset from the center of the main lobe till day 364, December 30th to keep the HGA feed assembly cool. From now on, the NOAA antenna partners will gradually be able to close the RF link on the space weather broadcast in between DSN or ESA tracks.
- On day 314, during the DSS-14 support, moved SSR read pointers for IMPACT, PLASTIC, SWAVES, and G&C partitions to one and began SSR playback of recorded data since commencing HGA side lobe operations on day 2014-231, August 19th, 2014.

- On day 316, during the DSS-43 support, began second playback of SSR data by moving SSR read pointers for IMPACT, PLASTIC, SWAVES, and G&C partitions to one and C&DH partition to 882740.
- On day 319, during the DSS-43 support, the original macro 237 was loaded to C&DH RAM to restore the real-time telemetry rates to the following prime science allocations during the 360 kbps downlink supports.
 - IMPACT & PLASTIC = 3.2 kbps each
 - SECCHI = 3.6 kbps
 - SWAVES = 2.2 kbps
 - Space weather = 0.633 kbps
- On day 319, the space weather broadcast was not available from 2320z through 320-1030z to allow the real-time telemetry queues to empty in preparations for returning the instruments to nominal daily science operations.
- Processing status of the in-situ instrument space weather data recorded during the 15 months of side lobe operations:

This week, the following days were processed with the associated data products available on the MOC STEREO Data Server and GSFC SSC websites:

Day 2014-231 through day 2014-331
(August 19th, through November 27th, 2014)
- The average daily science data return for Ahead, with the HGA on the main lobe riding along a one degree offset, was 371 Mbits during this week.

STEREO Behind (STB) Status:

1. The following Ground System anomalies/events occurred during this reporting period:
 - None.
2. Detailed status of the recovery activities to restore operations from the Behind loss of communication anomaly, which occurred on day 2014-274, are listed below.

- The Behind observatory entered superior solar conjunction at the 2.0 degree SPE angle on day 022. Recovery efforts resumed post solar conjunction on day 124, May 4th through day 178, June 27th, as the spacecraft had cleared solar interference for LGA communications. The Failure Review Board recommendations were implemented consisting of battery state of charge recovery and powering on the downlink carrier. The Green Bank Radio Telescope and the Arecibo Observatory also observed the carrier recovery tracks. To date, no downlink signal has been detected from the Behind observatory since the anomaly occurred. Due to Behind's retrograde motion causing it to re-enter the region of solar interference, recovery operations have been suspended and will resume on November 30th.
- The Failure Review Board's recommended faster frequency segmented acquisition sequence was tested with the Ahead observatory on day 272, September 29th. All 18 one kHz frequency steps were tested twice. While stepping down through the 1 kHz segments, on segment #9 going down in frequency, the transponder locked to the BLF and accepted 9 no-op commands as expected. An interesting finding, but not unexpected, was that the transponder continued to follow the moving carrier and accept all commands sent for the remaining 27 segments.
- Testing of the DSN uplink arraying capability using the Ahead observatory resumed on day 281, October 8th, with the 3rd uplink array test successfully conducted for STEREO using DSS-24 and 25. This test consisted of two 34m stations, each with a 20 kW transmitter using the HGA 1st side lobe with the Ahead observatory with the MOC sending no-op commands. An approximately 6 dBm increase in received signal power was demonstrated, as compared to one 34m uplink, at the spacecraft with all 30 no-op commands being received correctly using the 7.8125 bps uplink rate. The 4th uplink array test is scheduled for day 323, November 19th, testing the phasing of 80 kW and 20 kW transmitters on the HGA main lobe. When the uplink array capability is ready, it will be used to increase the spacecraft received signal power to assist with Behind recovery commanding.
- With time the spacecraft range improves RF communications and the ability for other assets to acquire data on Behind. While the STEREO RF link was not designed to be closed beyond 2 AU, as the Earth range is now decreasing, the LGA

uplink margin returns to nominal, 6 dB for the 7.8 bps rate, in March 2016 and the LGA downlink margin returns to nominal, 3 dB for the 12 bps rate, in December 2016.

Significant findings to date:

1. Analysis of the three DSN extracted telemetry frames from the carrier signal just before the planned observatory reset/anomaly occurred on day 2014-274, October 1st, showed nominal performance of the spacecraft, i.e., no anomalies, IMU off, and the star tracker providing an attitude solution.
2. Post reset, from the very limited telemetry, three packets, extracted from the carrier signal by the DSN, the X-axis gyro on IMU-A had failed. Unfortunately, this telemetry contained only G&C anomaly data and no spacecraft summary data, i.e., the state of the RF, G&C, fault protection and other subsystems is not known at the time of the anomaly. With a failed IMU and the star tracker being off-line for an undetermined duration, the sun sensors will keep the observatory pointed at the Sun, though the G&C will not have any roll knowledge, and cannot roll the observatory as part of the safing configuration to re-establish communications on the LGAs. From analysis of this telemetry and initial G&C simulations, it is highly suspected that the observatory is rotating about the principal axis of inertia due to an autonomous momentum dump initiated by biased gyro data flagged good by the IMU, but this has not yet been confirmed.
3. At least two anomalies occurred post reset, the star tracker not promoting to AAD mode and the X-axis gyro failure. Unfortunately, due to the number of possible combinations, the STEREO fault protection system is not designed for simultaneous failures.

Once communications are restored and the anomaly resolved, the Behind observatory will be returned to nominal science data collection as soon as it is safely possible.